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בקשה לפטנט
Application for Patent

לשימוש הלשכה
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160783	מספר: Number
08-03-2004	תאריך: Date
	הוקדם/נדחה Ante/Post-dated

אני, (שם המבקש, מענו – ולגבי גוף מאוגד – מקום התאגדותו)
I (Name and address of applicant, and, in case of a body corporate, place of incorporation)

דוד כהן
רח' המעלות 1 דירה 5 רמת אביב

ששמה הוא: Owner, by virtue of — יוזם ועמלו — בעל אמצאה מכח of an invention, the title of which is:

(בעברית) (Hebrew)

(באנגלית) (English) situation Monitoring in Virtual Reality

hereby apply for a patent to be granted to me in respect thereof. מבקש בזאת כי ינתן לי עליה פטנט.

* בקשת חלוקה – Application for Division	* בקשת פטנט מוסף – Application for Patent of Addition	* דרישת דין קדימה Priority Claim		
מבקשת פטנט from Application	* לבקשה/לפטנט to Patent/Appl.	מספר/סימן Number/Mark	תאריך Date	מדינת האיגוד Convention Country
No.______ מס'	No.______ מס'			
dated______ מיום	dated______ מיום			

* יפוי כח: כללי/מיוחד – רצוף בזה / עוד יוגש
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טופס זה, כשהוא מוטבע בחותם לשכת הפטנטים ומושלם במספר ובתאריך ההגשה, הינו אישור להגשת הבקשה שפרטיה רשומים לעיל.
This form, impressed with the Seal of the Patent Office and indicating the number and date of filing, certifies the filing of the application, the particulars of which are set out above.

Delete whatever is inapplicable [illegible] *

Inventor(s) : David Cohen

Title of the Invention

Situation Monitoring in Virtual Reality

Field of the Invention

The present invention relates to situation monitoring using virtual reality

Background of the Invention

It is desirable to know when personnel encounter emergency situations. In particular security personnel including night watchman and guards, airline pilots, truck and van drivers and the like can be the subject of attacks and other emergencies with which they are unable to cope. In such a case it is desirable for the subject of the attack to call for help, but sometimes the nature of the emergency renders calling for help impossible. Likewise, elderly and other vulnerable persons, particularly those living on their own, can find themselves in difficulties and unable to reach a telephone to call for help, for example after a fall.

In cases where it is not possible to call for help, a number of systems exist for automatically determining that an emergency situation exists and calling for help.

Hospital-based systems that monitor a patient's pulse and call a doctor or nurse if the pulse falls are well known but are not suitable for anything other than the hospital environment.

Aircraft based hijack warning systems rely upon the pilot's standard radio-based voice link to air traffic control or include panic buttons for broadcasting an SOS signal. Hijackers however tend to be familiar with the presence of these systems and either use them to their advantage or prevent their use altogether.

Other systems for protecting aircraft from emergencies tend to rely on pilots' reaction times. Certain types of emergencies happen too quickly for the pilots to be able to raise the alarm or divert the pilots to emergency activity without diverting their attention to raising the alarm.

Often, the ability to determine what has happened following an aviation disaster is dependent on finding the aircraft flight recorder or black box.

Israel Patent Application No. 145498 to the present applicant discloses a system for detecting cockpit emergencies comprising the following:

a) an input unit for receiving body stress level information from at least two subjects,

b) a detection unit, associated with said input unit, for comparing stress level information from said at least two subjects, to detect substantially simultaneous stress level increases in said subjects,

the system being operable to threshold detected simultaneous stress level increases to infer the presence of an emergency situation and to enter an alarm state.

The system uses the physiological state of the pilots to determine that an emergency situation has arisen. In order to reduce false alarms it takes data from the two pilots and deduces the presence of an alarm when both pilots indicate stress. Such a system has the disadvantage that it is only useful in situations such as the cockpit of a civil aircraft where two or more persons are likely to undergo the same emergency. The system is not applicable to security guards, elderly people living alone and the like. Likewise it is not applicable for monitoring of persons being sent into dangerous situations such as troops into battle or firemen into a burning building.

Another situation in which monitoring of the physiological and motion state of a human subject is useful is in virtual reality applications such as virtual reality games in which a subject's action is followed in real time on a computer screen or in the use of actors to create animated characters for animated films or games. Generally these applications are achieved by monitoring a large number of points on the subject's body and incorporating

them into a triangulated 3D model which reproduces the subject's movement with great accuracy. Unfortunately this produces a very large amount of data and requires a very large amount of processing. It also requires complex and specialized equipment for monitoring the movement of all of the points on the subject's body in three dimensions.

Summary of the Invention

According to the present invention there is provided emergency situation detection apparatus comprising:

a stress input unit for receiving body stress level information from a subjects,

a physical input unit for receiving body physical reaction data from said subject,

a comparator unit, associated with said stress input unit and said physical input unit, for comparing stress level information and physical reaction data, to detect substantially simultaneous stress level increases and a physical reaction in said subject,

said apparatus being operable to threshold said simultaneous detection to infer the presence of an emergency situation and to enter an alarm state.

Brief Description of the Drawings

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, purely by way of example, to the accompanying drawings.

With specific reference now to the drawings in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of the preferred embodiments of the present invention only, and are presented in the cause of providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the invention. In this regard, no attempt is made to show structural details of the

invention in more detail than is necessary for a fundamental understanding of the invention, the description taken with the drawings making apparent to those skilled in the art how the several forms of the invention may be embodied in practice. In the accompanying drawings,

Fig. 1 is a simplified diagram of a detection device according to a first embodiment of the present invention;

Fig. 2 is a simplified diagram showing the detection device of Fig. 1 in greater detail; and

Fig. 3 is a simplified diagram showing a 3d virtual figure for providing an intuitive user front end for monitoring the state of a subject or alternatively for providing a way of translating motion of the subject into an animation for a virtual reality game or an animated film or the like.

Description of the Preferred Embodiments

The present embodiments provide a physiological situation and 3D motion detector which uses physiological responses of subjects such as the heart rate to measure mood or determine that an emergency situation exists and to automatically raise an alarm. An additional signal is taken from an independent motion detector which measures three-dimensional motion of the body, perhaps using a position detector or an accelerometer or both.

In an embodiment, additional motion detectors are added to any of the head, arms and legs as desired. The motion detectors are preferably passive signal sources whose positions are detected by triangulation from two points on the main device.

For emergency situation detection the signals from the stress and the motion detector are monitored together to obtain an indication that such a situation has arisen. The use of both signals provides protection against false alarms say caused by self-induced anger, pure fright unaccompanied by an attack, and the like to which individual subjects may be susceptible. The signals may be measured against a threshold, or a delta may be used.

In a broader sense the present embodiments provide indications of dangerous situations arising or of circumstances that could lead to dangerous situations. For example, the embodiments may be able to from physiological measurements that a security guard has fallen asleep, and therefore is not doing his duty of guarding.

When used for virtual reality, the main interest is the position or motion detection. However the physiological detection can provide a mood indication.

In the preferred embodiment the signals are translated into the motion of a three-dimensional animated figure on the screen. The figure uses the signals to replicate the mood and the motion of the subject. Thus in emergency situation detection a monitoring party has an intuitive user friendly indication of the state of persons he is monitoring, and in animation and games the animated character moves in accordance with the motions of the actor or player but without needing expensive detection equipment or large scale processing ability.

Before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of the components set forth in the following description or illustrated in the drawings. The invention is applicable to other embodiments or of being practiced or carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein is for the purpose of description and should not be regarded as limiting.

Reference is now made to Fig. 1, which shows an emergency situation detection apparatus placed on a user.

In Fig. 1, a subject 10 has an emergency situation detector 12 attached thereto. The detector 12 comprises bodily function detector 14 and physical reaction detector 15. The bodily function detector may for example detect pulse rate or sweat levels of the subject. Preferably the detector may be concealed beneath the subject's clothing. The detector 12 is preferably able to send signals in non-contact manner to emergency situation detection apparatus 16.

The bodily function detector 14 receives physiological body stress level information. The physical reaction detector preferably detects sudden movements, or indications of an impact of some kind or the attainment of a horizontal position or like indicators of physical reaction. An impact detector may for example comprise a piezoelectric sensor. Neither physiological stress alone nor physical reaction alone are reliable indicators of an emergency situation but both taken together may be expected to increase the reliability of any determination of an emergency situation.

Reference is now made to Fig. 2, which shows the detector 12 in greater detail. Preferably a comparison unit 20 is associated with the bodily function and reaction detectors, for comparing signal information to determine substantially simultaneous occurrence of stress level increase and physical reaction in the subject. The detections may be thresholded as deemed sensible by the skilled person to increase reliability of detection. Different thresholds may be appropriate for different kinds of subject. Thus elderly people may be better served by a lower threshold than a security guard. As a further alternative, instead of a fixed threshold level, the system may monitor the change in signal level over time. The change or delta may then be thresholded. Thresholding the deltas can distinguish high signal levels which are due to a rapidly occurring event from high signal levels which may be due to background stress and the like.

The thresholded output of the comparison unit, following a positive result of the thresholding, is passed to an alarm state manager 28 to imply the presence of an emergency situation and to enter an alarm state.

Preferably the alarm state manager is able to call for assistance, for example via automatic opening of a radio link, or of a video link, to a central controller, thus to provide immediate indication of an emergency state. Preferably, the link, which is at least an audio link, includes at one end a speaker and or microphone located on the body of the user.

In a further preferred embodiment specifically for an aircraft cockpit, the alarm state manager is able to initiate an automatic download of the aircraft's

flight recorder or black box data to a central controller, thus making available flight information even if the black box is never recovered.

The alarm state manager is preferably also able to enter an alarm state under the influence of other detectors, for example with detection of a loud noise or following prolonged instability. The alarm state manager may be able to enter different levels of alarm states prompting different actions.

In a further preferred embodiment of the present invention, the emergency situation detector includes an audio or other confirmation channel which can be opened upon detection of an emergency in order to provide confirmation of the situation or allow two-way communication, or the like.

In a further preferred embodiment the emergency situation detector 12 includes a GPS detector to provide positioning information. For use in a building or other places where GPS signals may not be available, a triangulation system may be installed for accurate positional information.

A further preferred embodiment intended for a user who stays within a predefined area, such as a security guard on patrol, simply sends regular code signals from which the system infers that he is in position.

Further preferred embodiments are provided to determine attitude, position and motion of a subject. Thus the emergency situation detector may include an accelerometer. A detector for detection of a direction that a user is facing may be strapped to the chest or a like part of the body. The detector includes a compass needle and the relative alignment of the compass needle relative to a predefined forward direction of the body provides information as to the direction the user is facing.

In an embodiment, additional motion detectors 16 are added to any of the head, arms and legs as desired. The motion detectors are preferably passive signal sources whose positions are detected by triangulation from two points on a main device 18. It is noted that main device 18 may replace detector 12. With the additional motion detectors it is possible to determine explicitly that the subject is running or walking or lying down or the like.

In a further preferred embodiment, emergency situation detectors are provided to two or more persons in a team. The signals from different members of the team can be compared to determine who is the closest to an event. For example the intensity of an audio signal as received from two different users can be compared to determine who was the closest to an explosion. The team can then be instructed accordingly to deal with the situation.

In one embodiment, data is stored for a predetermined time in a stack, for example a FIFO stack. The size of the stack may be a given amount of data, or may be a given amount of time, or some other factor as preferred. In the event of the detection of an emergency situation, all of the data currently in the stack is saved, so as to allow subsequent analysis. The stack embodiment is useful because it makes available information from directly before the emergency, often extremely useful in any investigation.

Embodiments of the present invention may use a private communication channel. Other embodiments may make use of existing channels such as the cellular network. Yet other embodiments may comprise universal communicators which make use of public networks if detected and use their own channel of communication otherwise.

According to a further embodiment a system comprises rule based logic and one or more body sensors for location on the subject. The subject is expected to follow certain behavioral rules, for example a guard patrols by walking around within a certain area. If he were to run or lie down it would be apparent that an abnormal situation may have arisen. Thus the sensor is usable in combination with the rule based logic to detect non-compliance with the behavioral rules, to indicate an abnormal situation and if necessary to set off an alarm or otherwise summon help. It will be clear that the more independent sensors are used the more reliable the determination can be.

In other circumstances, a guard may be expected to run and lie down to observe suspicious circumstances. In such a case the system may not react under such circumstances, but may await an additional indication such as an

impact or the sound of an explosion, or signs or rolling or the like, which may indicate that the guard is under attack.

In a preferred embodiment, the detectors are programmable. The rules can be changed for different users or for allowing the same device to given to different users having different requirements. The device can also be dynamically programmable according to parameters it is able to detect. Thus it may be able to use detected locations to change between different sets of rules. Or as another example, a device programmed for use by a fireman may change the rules it is using depending on the temperature it detects. In a further example the change of rules may be carried out on line, for example over a radio connection.

A position or location detector may be used in combination with the above system and the rules preferably define location-based behaviors.

For emergency situation detection the signals from the stress and the motion detector are monitored together to obtain an indication that such a situation has arisen, as described above. The use of both signals provides protection against false alarms say caused by self-induced anger, pure fright unaccompanied by an attack, and the like to which individual subjects may be susceptible. The signals may be measured against a threshold, or a delta may be used.

When used for virtual reality, the main interest is the position or motion detection. However the physiological detection can provide a mood indication.

In the preferred embodiment the signals are translated into the motion of a three-dimensional animated figure on the screen. Reference is now made to Fig. 3 which shows figure 30 that uses the signals to replicate the mood and the motion of the subject. The figure is a simplified figure and may be a preconfigured animation.

Thus in emergency situation detection a monitoring party has an intuitive user friendly indication of the state of persons he is monitoring, and in animation and games the animated character moves in accordance with the

motions of the actor or player but without needing expensive detection equipment or large scale processing ability.

If the subject being monitored is himself watching the screen then the animated character provides an interactive feedback to the subject. It is possible to carry out recreational and physical excercises and training with immediate and personalized feedback. A subject can be warned if he is not carrying out an exercise correctly or is carrying it out in a dangerous manner. This may be determined by comparing the movement with a predetermined program of movements or comparing the movements with a feature on the virtual reality screen. Furthermore movement of a ball or the direction of a virtual gun can be monitored in combination with the movement of the subject to decide whether a participant in a game has scored points or is killed or the like.

The system can monitor for sounds and the like for emotional content, for example laughter, crying and the like. Likewise the system can monitor the physiological signals for emotional cues. The emotional cues are then transferred to the animated figure.

As a further example if something happens to a subject being monitored, such as him being attacked, the animated figure clearly shows what is happening or what has happened to him at a particular time, since the information can be stored and replayed.

It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable subcombination.

It will be appreciated by persons skilled in the art that the present invention is not limited to what has been particularly shown and described hereinabove. Rather the scope of the present invention is defined by the appended claims and includes both combinations and subcombinations of the

various features described hereinabove as well as variations and modifications thereof which would occur to persons skilled in the art upon reading the foregoing description.

Claims

1. Device for virtual reality representation of a subject being monitored, the apparatus comprising:

a measurement part comprising:

a physiological data input unit for receiving physiological information from said subject,

a motion unit for receiving body motion data from said subject,

a comparator unit, associated with said physiological data input unit and said motion unit, for comparing physiological information and physical reaction data, to determine an overall state of said subject, and

a monitoring unit for using signals received from said measurement part to animate a virtual animation character at a remote location, thereby to provide an indication of a current state of said subject.

2. The device of claim 1, wherein at least said physiological input unit and said motion unit are configured for attachment to said subject.

3. The device of claim 2, wherein said comparator unit is configured for attachment to said subject.

4. The device of claim 3, wherein said motion unit comprises passive position detectors connected to a plurality of locations on said subject and a triangulation unit for detecting relative motions of said passive position detectors.

5. The device of claim 1, wherein said stress level information comprises pulse rate information.

6. The device of claim 1, wherein said stress level information comprises breathing rate information.

7. The device of claim 1 wherein said stress level information is sweat level information.

8. The device of claim 1, adapted to use said physiological data to apply an emotional state to said animated figure.

9. The device of claim 1, configured to interpret extremely low stress level information as said subject being in a state of sleep.

10. The device of claim 1, wherein said motion unit further comprises an inclination detector affixed to said subject.

11. The device of claim 1, wherein said motion unit comprises an accelerometer.

12. The device of claim 1, wherein said measurement unit is responsive to transmitter units placed on said subjects.

13. The device of claim 1, wherein said measurement unit is operable to enter an alarm state under predetermined conditions and said alarm state comprises automatic opening of a communication channel to a central controller.

14. The device of claim 1, wherein said predetermined conditions include a position likely to cause injury.

15. The device of claim 13, wherein said alarm state comprises automatic opening of an audio channel to a central controller.

16. The device of claim 15, wherein an end of said audio channel is located on said subject.

17. The device of claim 13, wherein said alarm state comprises automatic opening of a video link to a central controller.

18. The device of claim 13, said alarm state being additionally triggerable by at least one of an instability monitor, and a loud sound monitor.

19. The device of claim 1, sized and configured for mounting unobtrusively on a subject.

20. The device of claim 1, further comprising location detection functionality for determining a location, said apparatus further being configured to report said location.

21. The device of claim 20, wherein said location detection functionality is one of a group comprising a GPS detector and a triangulation system.

22. The device of claim 1, further comprising a direction sensor, said direction sensor comprising a compass needle and functionality for measuring an angle of said compass needle in relation to a reference.

23. The device of claim 1, associated with a memory stack for storing a predetermined amount of immediately preceding data, said detector being configured to save all data in said stack upon entry into said alarm state.

24. The device of claim 1, further configured to apply scoring to an action of said subject.

25. The device of claim 24, wherein said action is scored in relation to a feature in virtual reality.

26. The device of claim 24, wherein said action is scored in relation to a predetermined program.

27. The device of claim 23, wherein said predetermined amount of data is usable for animating said figure.

28. Device for virtual reality representation of a subject being monitored, the apparatus comprising:

a measurement part comprising a motion unit for receiving body motion data from said subject, and

a monitoring unit for using signals received from said measurement part to animate a virtual animation character at a remote location, thereby to provide an indication of said overall state.

29. The device of claim 28, wherein said motion unit comprises passive position detectors connected to a plurality of locations on said subject and a triangulation unit for detecting relative motions of said passive position detectors.

30. The device of claim 28, wherein said motion unit further comprises an inclination detector affixed to said subject.

31. The device of claim 28, wherein said motion unit comprises an accelerometer.

32. The device of claim 28, wherein said measurement unit is responsive to transmitter units placed on said subjects.

33. The device of claim 28, wherein said measurement unit is operable to enter an alarm state under predetermined conditions and said alarm

state comprises automatic opening of a communication channel to a central controller.

34. The device of claim 28, wherein said predetermined conditions include a position likely to cause injury.

35. The device of claim 33, wherein said alarm state comprises automatic opening of an audio channel to a central controller.

36. The device of claim 35, wherein an end of said audio channel is located on said subject.

37. The device of claim 33, wherein said alarm state comprises automatic opening of a video link to a central controller.

38. The device of claim 33, said alarm state being additionally triggerable by at least one of an instability monitor, and a loud sound monitor.

39. The device of claim 28, sized and configured for mounting unobtrusively on a subject.

40. The device of claim 28, further comprising location detection functionality for determining a location, said apparatus further being configured to report said location.

41. The device of claim 40, wherein said location detection functionality is one of a group comprising a GPS detector and a triangulation system.

42. The device of claim 28, further comprising a direction sensor, said direction sensor comprising a compass needle and functionality for measuring an angle of said compass needle in relation to a reference.

43. The device of claim 28, associated with a memory stack for storing a predetermined amount of immediately preceding data, said detector being configured to save all data in said stack upon entry into said alarm state.

44. The device of claim 28, further configured to apply scoring to an action of said subject.

45. The device of claim 44, wherein said action is scored in relation to a feature in virtual reality.

46. The device of claim 44, wherein said action is scored in relation to a predetermined program.

47. The device of claim 43, wherein said predetermined amount of data is usable for animating said figure.

48. Device for virtual reality representation of a subject being monitored, substantially as hereinbefore described with reference to the accompanying drawings.

49. Virtual reality representation method of a subject being monitored, substantially as hereinbefore described with reference to the accompanying drawings.

David Cohen

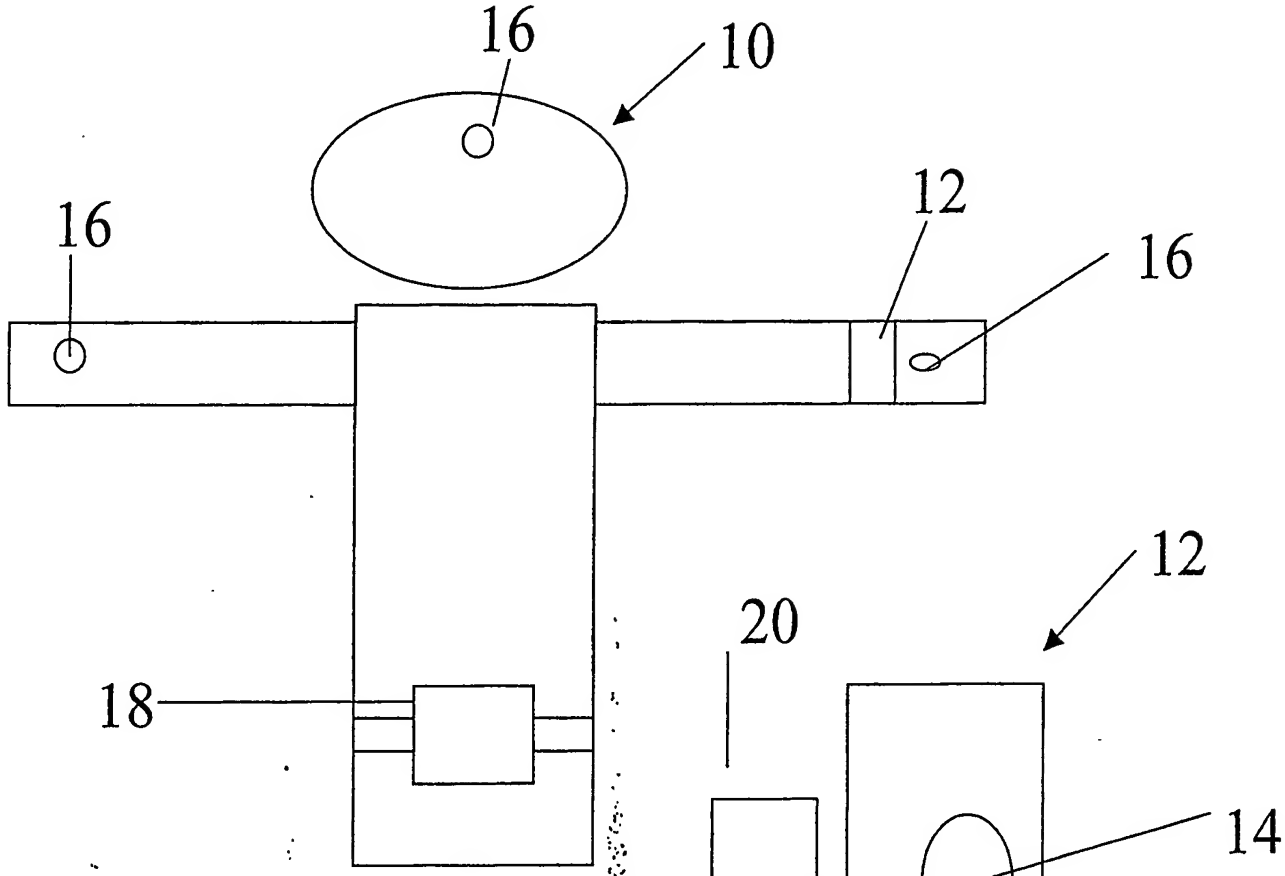

Fig. 1

Fig. 2

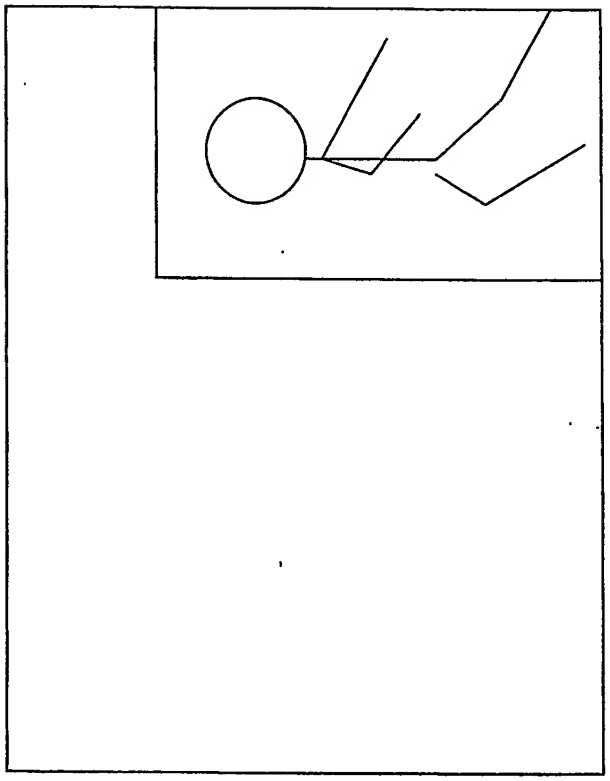

Fig. 3